

AGT1500 Engine
First Article Test Qualification Plan Requirements

Part Number: 12472668 and 12472672 (casting)

Part Name: 2nd Turbine
Nozzle

The requirements to qualify a new source of supply for the subject component are as follows:

1. **Casting Work Instructions/Process Sheets** in detail for review and approval prior to casting components for qualification
2. **Work Instruction/Process Sheets** in detail for review and approval prior to manufacturing components for qualification
3. **Samples required for qualification of this component** are 1 casting for metallurgical analysis, 1 finished part for materials evaluation for verification of fabrication processes, and 1 finished part for engine testing.
4. **First Article Inspection Reports** – casting airfoil charts and 100% of the characteristics/drawing requirements, including all details of a machined piece identified by serial number. The serialized component is to be included in the quantity being submitted for qualification.
5. **Certificate of Conformance** – A statement attesting to complete conformance to Government Purchase order/Ordinance Drawing Requirements.
6. **Certification(s) of Special Processes** For the purposes of this estimate, casting substantiation includes the manufacture of the raw casting, 12472672. Manufacture of the Casting Assmbly, 12472670 entails manufacturing of ,and brazing in the metering plates and EDM machining. These are considered part of the machining processes. Special processes for this component are:

Casting

Casting fixed processes

Liquid penetrant inspection

Effective flow area measurements

Machining

Spot Weld

Nickel braze

Braze Inspection

Heat treat

Liquid penetrant inspection

Effective flow area measurements

Electrical discharge machining (EDM)

Honeycomb control

These processes must be approved prior to the manufacture of this component. Special processes may be subcontracted only to sources approved by the procuring activity. The certificate shall specify the process specification number and latest revision letter, process name, and name of the processing facility.

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7. **Material Certification(s)** – To include chemical and physical properties from raw material supplier(s).

Honeywell Engines will perform the following tasks on the provided samples and documentation:

1. One finished casting will be sectioned to evaluate metallurgical properties relative to the drawing requirements. Final casting certification cannot be concluded until the completion of the evaluation of the finished-machined part per number 2, below.
2. One finished part will be sectioned to inspect for metallurgical anomalies relative to all drawing/specification material requirements. All vanes will be visually and dimensionally inspected and have NDT collaborated, including EFA flow calibrations.
3. One finished part will be subjected to 25 hours of mission profile engine testing. Following engine testing, the hardware will be subjected to a visual inspection, EFA, and FPI.
4. Engineering and Quality personnel with specific expertise will review all the information submitted by the vendor to ensure that there is sufficient process control capability in place to consistently meet the drawing requirements.
5. Findings from all investigations will be compiled and a final report issued to TACOM.

Development of a new casting will take 17 months as detailed below. This estimate assumes one tool and process iteration before substantiation castings are completed. This is not uncommon. If multiple iterations are required, additional effort would need to be spent to complete the substantiation. Per this plan, castings will be delivered to the machining floor after the first iteration, or, 15 months. Final substantiation of the castings cannot be completed until the metallurgical analysis of the machined part is complete. The major tasks and timing for 2nd nozzle casting substantiation per this estimate are:

Develop casting tooling and processes	6 mo
FAIR castings and packages	4 mo
FAIR review	2 mo
Tool and process iteration	1 ½ mo
Substantiation castings and packages	1 ½ mo (useable castings available)
Review substantiation packages	<u>2 mo</u>
	17 mo

Development of a new machining vendor will require approximately 19 months, much of which is accomplished concurrently with development of the casting. Machining for this part is moderately complex due to the brazing, so an iteration of machining processes is included. However, it is assumed that a part suitable for testing is available from the

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FAIR parts. If multiple machining iterations become necessary, additional effort would need to be expended. This may even delay testing if suitable test candidates cannot be selected from the FAIR parts. The major tasks and timing for 2nd nozzle machining substantiation per this estimate are:

Develop machining tool and processes	12 mo (concurrent with casting)
FAIR parts and packages (castings available)	2 ½ mo (part available to test)
Review FAIR packages	1 ½ mo
Iterate fabrication processes	1 ½ mo
Review of process updates	<u>1 mo</u>
	18 ½

The engine test and subsequent documentation will add approximately 2 months to the overall schedule. As shown on the attached schedule, the entire program, as estimated and time phased, should take about 24 months to complete.

The estimated Honeywell Engineering cost of the qualification requirements as stated, is approximately \$ 125K. It is based upon similar efforts conducted at the Honeywell, Phoenix facilities.

The estimate provided assumes that the potential supplier is Honeywell-approved. If a non-approved source is selected, the cost to substantiate can be 3 to 4 times the estimated amount due to the requirements for quality audits and certifications required to ensure manufacturing and quality capabilities. If Honeywell Engines personnel are required for evaluating such a candidate supplier, a separate RES should be issued to assess schedule and costs.

These schedule and cost estimates are based on current manpower and remain in effect for 90 days.

Vendor qualifications, based on the aforementioned requirements, are subject to the following clauses:

Clause 1: While Honeywell Engines will strive to identify at least all major deficiencies and improvements discovered during its qualification evaluation and/or testing of a product, Honeywell Engines does not imply that correction of deficiencies or incorporation of improvements identified by Honeywell will result in an acceptable product. Evaluation of corrected or improved product may reveal previously unidentified deficiencies or improvements.

Clause 2: The restrictive marking of proprietary rights claim on the vendor's data may not be appropriate in view of the clause at DFARS 52.227-7013 of the department of Defense federal Acquisition Regulation Supplement (DFARS).

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Substantiation Plan for 2nd Stage Nozzle Casting and Machining

